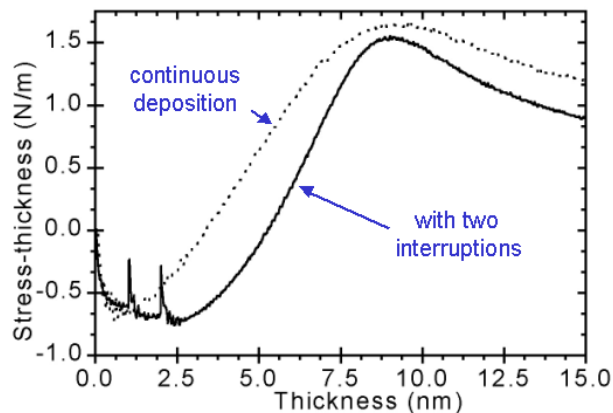


Stress and Structure Evolution During Formation of Polycrystalline

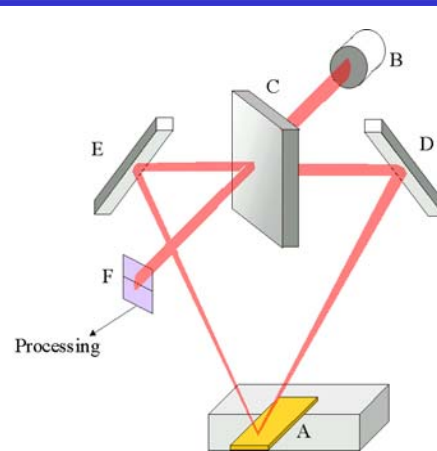
Metallic Films: From Adatoms to Coalescence

DMR-0302044: Carl V. Thompson, Department of Materials Science and Engineering, M.I.T.

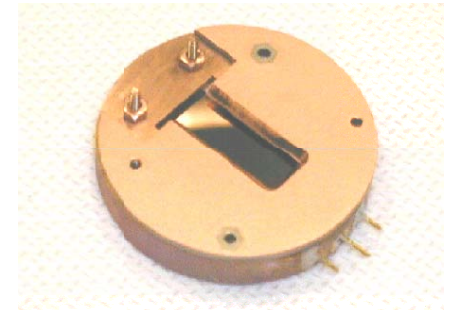
New high-sensitivity techniques for real-time, in-situ thin film stress measurements have been developed:



Stress evolution during deposition of Cu films.



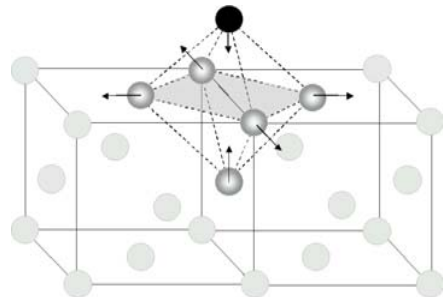
Laser-deflection from a cantilever tip is measured using a system fabricated as a single unit and immersed completely in the deposition system.



Capacitance-based device for measurement of cantilever displacement with 1kHz frequency, and with <1nm resolution.

The entire device and cantilever can be transferred through a loadlock system.

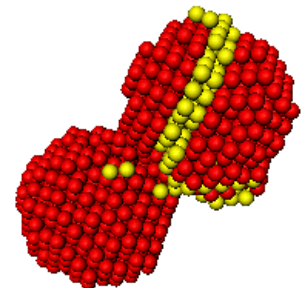
Reversibly relaxed compressive stresses are observed in all stages of Volmer-Weber growth, and in homoepitaxial growth. These are associated with changes in surface defect structures.



C. Friesen and C.V. Thompson, Phys. Rev. Lett. **89**, 126103 (2002).
C. Friesen, S.C. Seel, and C.V. Thompson, J.A.P., in press.

Tensile stresses are associated with island coalescence.

MD simulation showing elastic and inelastic deformation.



Educational and Outreach Activity

DMR-0302044: Carl V. Thompson, Department of Materials Science and Engineering, M.I.T.

Results from NSF research have been included in MIT courses;

3.44* Electronic Materials and Thin Film Processing, and

3.48J** Materials and Processes for Microelectromechanical Devices and Systems

and courses for professional engineers and scientists in summer short courses;

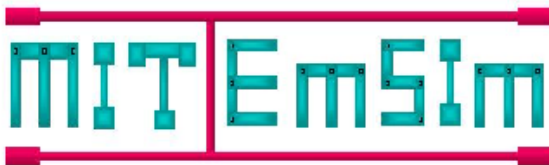
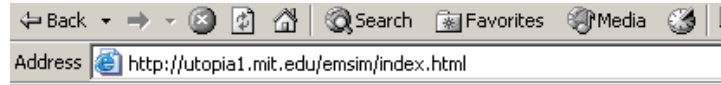
3.50s Thin Films and Small Volume Structures: Stresses, Deformation and Reliability

6.74s Multilevel Interconnect Process Technologies for Microelectronic Fabrication

*simultaneously attended by students

in classrooms in Singapore as well as MIT

** jointly offered with 4 other Engineering departments at MIT, and ***simultaneously attended by students in classrooms in Cambridge UK, Singapore, and MIT***



NSF research results have been incorporated in an interconnect reliability assessment tool widely used in industry.

NSF work involves collaborations with 2 other faculty at MIT and one in Singapore, research results are discussed in group meetings of all groups (and in regular videoconferences with Singapore, below).

